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Selecting the
Heating Boiler

SELECTING a Heating Boiler is somewhat like choosing a wife. A wise selection will bring continuous joy but an unwise one results in incessant harassment—fatal to the fine purposes of the enterprise.

The importance attaching to the selection of the boiler, arises from the relation which heat bears to the serviceability of the building and to the operation of the enterprise housed therein. Heat is such a primary necessity, that without it, in cold weather our schools must dismiss or our business enterprise cease. To get the full force of this statement, let us visualize a modern business or educational institution fully equipped with the requisite building plant and operative staff. If the boiler (which is the heart of the heating plant) should fail to deliver the required heat, the whole enterprise will be chilled into disorder and the whole building investment will become for the time unproductive. The

wise builder knows he is not merely spending so many dollars in buying a boiler, but is in reality guaranteeing the whole building investment and insuring the continuity of the operation of the business itself — he therefore weighs carefully each consideration involved in selecting the boiler.

What then *are* the considerations involved in selecting a steam heating boiler—the questions to which a builder should find the correct answer? These considerations divide themselves very naturally into two groups; the things one wants to obtain, and the price one has to pay for them. In other words, desires and costs.

The things one wants to obtain, and must have from a steam boiler, are:

- (a) dry steam (or let us say “quality” steam).
- (b) adequate steam (or quantity).
- (c) dependable steam (dependability of supply).

Let us consider them in the order named.

DRY STEAM is a term which means, when used in connection with a steam heating system, just *steam*—and not a

mixture of steam and foamy water. There are two reasons why dry steam is essential. The distribution system, consisting of piping, radiation and accessories, is never designed to accommodate anything but dry steam and the amount of water normally produced when steam delivers its heat. When water is forced from the boiler into the distribution system, it invariably sets up a whole train of troubles—hammering, snapping, cold radiators, etc. A system of steam distribution may be perfect, but a “geyser” type boiler will make it sound like the battle of Gettysburg and in addition render it impotent to deliver comfort throughout the building.

On the other hand, the constant presence of a correct supply of water *within the boiler* is necessary to the well being of the boiler itself. If all, or a considerable part, of the water should leave the boiler while it is being fired, the boiler members would quickly become overheated (sometimes red hot) resulting in warping or (if the boiler material be cast iron) in cracking; also explosion, if water is fed in. A shut-down for repairs is then unavoidable.

The cause of water priming from a boiler is directly a matter of the design of the boiler. Some, being made primarily to sell, are designed so sparingly as to material, that they are scarcely serviceable at all. Others are designed with a view first of the *service required*, and the amount, character and disposition of the material employed is subordinated to this end.

When a unit of water is converted into steam at atmospheric pressure, its size is increased about 1600 times. This conversion, occurring principally well toward the bottom of the water body, forms a bubble, or bubbles, which rise to the surface and burst, thereby liberating the steam. As these bubbles rise to the surface they create currents of the water running in the same direction. If the amount of steam bubbles rising to the surface, with relation to the amount of the water body, is very large, and well distributed, the tendency is to raise the whole water body, thereby filling the steam space and flooding the steam outlet. One has but to observe an open vessel containing an inch or so of water, when set upon a hot stove, to get a very

exact idea of what is occurring within a steam boiler at work. There must be a *proper relation* between the water body (or water content of a boiler) and the amount of steam to be created. Also, since the boiling of water in any boiler tends to fill the steam space, it is necessary that the steam space be so ample as to accommodate this tendency without becoming completely filled with this mixture of steam bubbles and water (drawn into their circulation routes). Boilers vary widely in this essential regard, frequently as much as 50 to 100 per cent.

Beware of a priming boiler as you would a plague. It not only defeats the purposes for which one employs it, but it has a marked disposition to destroy itself.

ADEQUACY is so apparent a requisite that it would seem almost superfluous to stop to consider it. There are, however, two ways in which the question of adequacy becomes involved in the problem of selecting the boiler. Some owners aren't entirely fair with themselves. For the sake of saving a niggardly

amount, they take the chance on a boiler doing more than it is represented as being capable of doing. Invariably, whoever undertakes to cheat himself, loses far more than he gains.

On the other hand, other buyers accept without question the ratings of capacity as given by the different boiler manufacturers. These ratings are expressed in terms of square feet of radiating surface to be served with steam by the boiler. Probably no two manufacturers use the same basis for making this calculation. Many of them base their calculations on using pure water within the boiler, whereas probably not as much as 5% of the water available throughout the country for boiler use is really pure water. Others base their calculations on the use of a certain grade of anthracite coal, whereas, only in small areas, is such coal commercially available. Others rate on the combined basis of grate area and heat absorbing surface, entirely overlooking the questions of the relevancy of water content and steam space. Men engaged in the heating contracting trade, a long time ago learned to their sorrow that many such ratings were, under act-

ual average operating conditions, a snare and a delusion. They know that some boilers will not serve, under all probable conditions, more than half the amounts which their makers claim they will. Fortunately, however, there are other manufacturers who, in rating their boilers, take into account all the ordinary contingencies which will probably arise, and strip down their ratings to practical terms. They tell you that their boiler, rated for a stated amount, when properly installed, is warranted to serve that same amount of radiation.

This is an important question. A buyer should be fair with himself, and likewise should require that a manufacturer be honest in his representations as to the duty capacity of his boiler.

DEPENDABILITY OF STEAM SUPPLY is, next to the assurance of quality and quantity, the most important consideration. A far-sighted buyer will consider the importance of continuity of service, and will select that boiler which affords best promise. Above we referred to the matter of design as affecting the quality of the steam produced, and incidentally said that those boilers which

primed tended to destroy themselves. The question of character of the material of which the boiler is made is also involved. This is particularly and specially so if the boiler be made of cast iron. To be sure, it does not help a steel boiler to be overheated when dry and then subjected to water, but with a cast iron boiler this is a calamity.

It is a part of boiler economy, that boiler breakdowns nearly always occur at the time of greatest load or strain. These peaks in boiler duty are invariably coincident with the time of greatest need of heat—a most unpropitious time for a boiler to stop work. The consequential damage or cost from want of heat—enterprise stopped, property temporarily unproductive, jeopardy to health from exposure — are often far more costly than the repairs.

This predisposition of certain types of boilers to break when put to the test is so great that a department of the insurance business has been created to meet the situation—"to repair cracked parts". Also, the annual crop of "cracked boilers" in this country is so large that a number of manufacturers of chemical

properties which it is claimed will, by internal application, stop these cracks, are doing a thriving business. Besides creating a distinct enterprise, this character of boiler has always, from its beginning, afforded its manufacturers a profitable "repair parts" business.

A peculiar situation, and an absolutely needless one, for there *are* boilers which *don't* crack—boilers on which it has not occurred to the insurance people to write a policy "to insure the repair risk"—boilers, over whose service career no "patent medicine" industry has arisen—yet some buyers so far lose sight of the real service for which a boiler is required, as to use this type.

While the foregoing considerations concern principally essentials which a buyer should seek to get when he buys a boiler, we have also suggested some of the costs (unnecessary ones) which an unwise choice will likely entail. Let us now examine that group of considerations which in any event an owner must look upon as costs. Some are one-time costs, while others are continuing, or perpetual cost. It would seem that any thoughtful buyer would be more con-

cerned with the perpetual costs than with the immediate, or one-time expenses. These cost items are pretty well covered and classified by the following designations:

1. OPERATING COSTS.
2. MAINTENANCE COSTS.
3. INITIAL COSTS.

OPERATING COSTS are to be classified as perpetual costs and should therefore assume relative importance in the buyer's consideration. The chief items in operating costs are (a) fuel cost, (b) convenience cost, and (c) labor cost.

FUEL COSTS vary quite widely as between boilers—as much as 50%. The conversion of fuel into steam divides itself into two heads—efficiency in burning, or converting the fuel into heat, and efficiency in absorbing, or using that heat. Some boilers are efficient in one and deficient in the other, or deficient in both, while some are efficient in both. A buyer should take whatever means are necessary to assure himself that the boiler he buys is the most efficient in

both, for his fuel charge goes on from year to year.

CONVENIENCE COST is a designation intended to cover the trouble of giving a boiler proper attention. Some are simple to operate and others are somewhat intricate; some are sturdy and some are delicate; some are easily kept clean, and others are so difficult to clean as to invite neglect. All these considerations involve continued yearly expense that can't be avoided, but the *amount* of this expense is a thing the buyer should look well into. It is reckoned that a $\frac{1}{4}$ -inch deposit of soot upon a heating surface reduces the heat absorbing capacity of that surface over 60%. The heating surface of some boilers is so constructed and disposed that it can't be gotten to at all, or if available, is so arranged that it is very difficult to clean. This either increases the "convenience cost", or conduces to neglect, which tremendously increases "fuel cost". *All heating surfaces of a boiler should be so formed and disposed that they may be easily and quickly cleaned.*

LABOR COSTS vary so widely as between different type boilers as to become

a fruitful subject for investigation by the buyer. Any disparities will continue from year to year.

MAINTENANCE COSTS are the costs which one will have to pay to cover normal depreciation and accidental injuries to the boiler. Under like conditions of good care the depreciation costs of different types of boilers will be about the same. It is a different story as to charges for repairs due to accidental injury. We have already under the subject of "dependability of steam service" referred to the predisposition of certain types of boilers to crack. There we spoke only of the consequential costs. The direct cost by way of replacing broken sections is a very important item. This is not a predeterminable cost—either as to the time of its occurrence or to the amount of the cost—and its very uncertainties render it the more unpleasant. When it occurs, (most likely in extremely cold weather) the plant must shut down for repairs. If a new section is necessary this must come from a distant place, the boiler must be disconnected and disassembled (to make the exchange) and then reassembled and

reconnected. What a needless expense and pother; what a burden of uncertainty for a constant companion—and all unnecessary.

INITIAL COSTS, of course, have their place, but when one has correctly evaluated the foregoing factors, the importance of initial cost becomes trifling in comparison. A boiler would be cheap at twice the cost of the most expensive if it alone had all the attributes to which reference has above been made.

Such are the principal essentials a buyer should have in mind in selecting a steam heating boiler. There may be others, but none of these should be lost sight of. Unless one gets these clearly in mind he cannot exercise good judgment in the matter.

But, having gotten these considerations in mind, how can the buyer winnow the truth from the widely conflicting claims made for competing products? There are at least four procedures which may be recommended to the seeker for truth.

First, there is the proceeding followed by many buyers of making the selection

of a concern the primary objective instead of giving primacy to the consideration of the product itself. Business has come so much to rest upon a basis of confidence that many business men will not trade with those in whom they cannot place their trust. They reason that, since practically all business transactions look to the future for the realization of the "desired service", someone's word has to bridge the span of time between the present, when one's money is put out, and that future time, when he will enjoy the results of his investment—someone's representations, for the time being, must be accepted in lieu of immediate service. The three "C s" which constitute the basis of personal credit are the same factors involved in bestowing one's confidence in a business concern. A cautious man will be sure that all three are there—Character—Capacity—Capital. *Character* is the moral fibre—the will to do the right thing; *Capacity* the knowledge of how to do the thing; and *Capital* the material means with which to do. Without any one of these the other two are worthless. Means are at hand for any buyer to learn the charac-

ter, capacity or ability, and resources of any concern with whom he proposes having a business dealing, and good business prudence directs that he do so before proceeding.

Second, one may avail himself of the experience of others who have grappled with the same problem. This he can and should do with all from among his friends, associates and acquaintances who have had contact with the problem. Then he should look out over the broader field of practice and find out what is meeting with general approval. When one finds in a wide competitive market a boiler which has been used in consistently and rapidly increasing quantity, through a long period of years, and which enjoys uniformly the high esteem of its users, he will likely have found the answer to his problem.

Third, one can turn the searchlight of common sense upon the claim made by the different producers and upon their answers to the questions above raised. The subject is not so highly technical but what the layman can get a pretty correct idea of the subject if he will but give to it his common sense consideration.

Finally, though this means is available to but few, one might test or have tested the available products wherever it is possible to do so.

Judgment is defined as the weighing of one set of circumstances against another set. Unless one does just that—first set up in his mind a schedule of requirements and then measure against them the evidence relating to the various offered products—his choice is not a decision or judgment, but a mere guess. The way to the realm of the satisfying heating plant lies through the gate of intelligent judgment.

—JOHN H. WATT.

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